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# THE HOME MODIFICATION OF COW'S MILK



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The home modification of cow's milk.  
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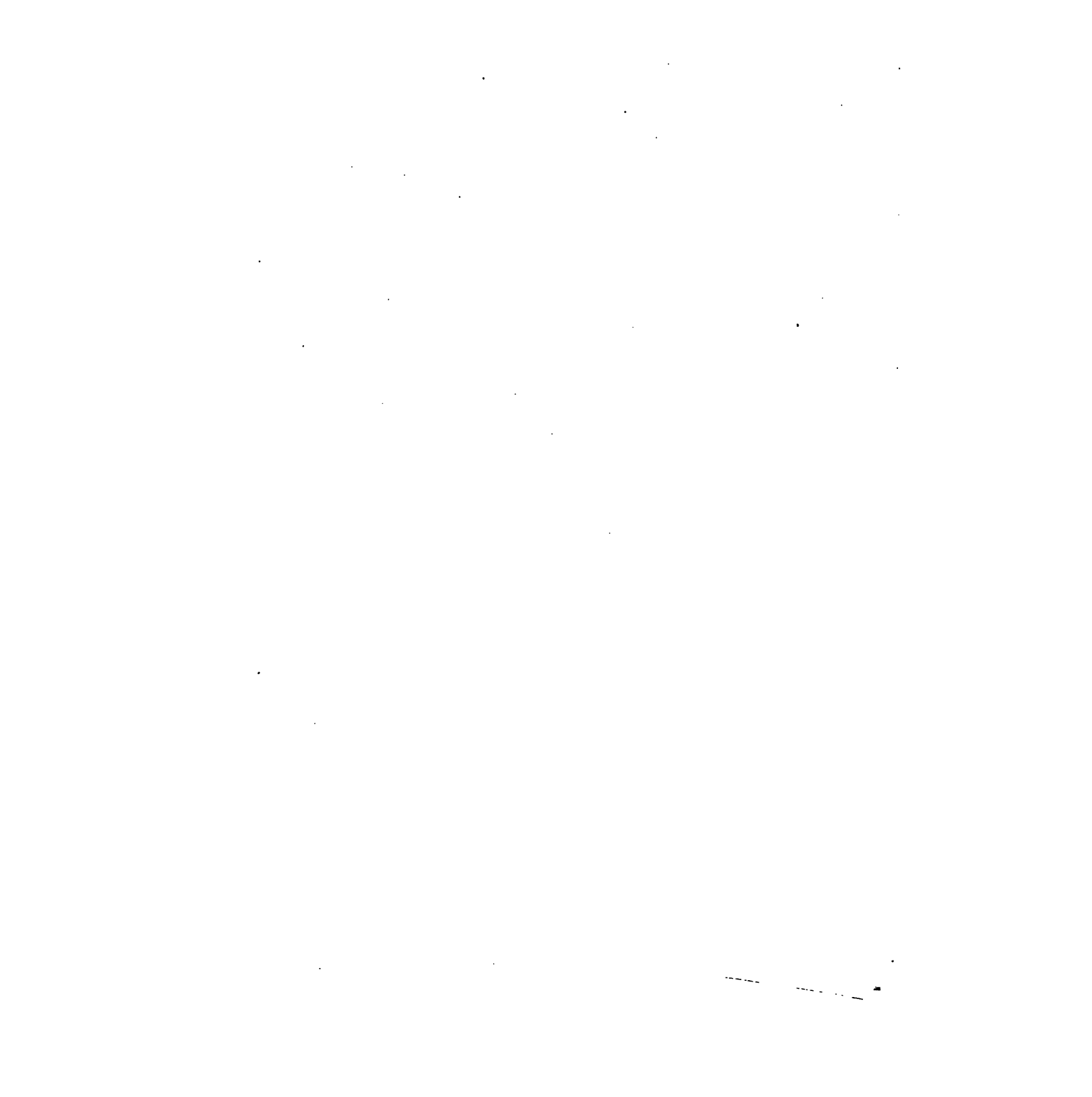
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*Gift*  
*Mellin's food company.*

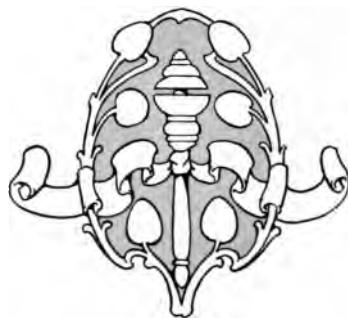
AMERICAN BANK NOTE CO. L. TWO





*“What can equal the glory and joy of the husbandman, as he follows his plough through the furrows of warm, rich soil?”*

THE  
HOME MODIFICATION  
*of*  
COW'S MILK



BOSTON MASS  
MELLIN'S FOOD COMPANY

1905

MP

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## THE HOME MODIFICATION of COW'S MILK



IT IS agreed by all authorities that fresh cow's milk must furnish the basis of operations in preparing a substitute for human milk. Cow's milk, however, even when fresh and pure, is, in its undiluted state, of such a nature that the infant cannot digest it, the difficulties arising from the large amount and peculiar properties of the casein. Casein being present in too large a proportion in cow's milk to be digested by the infant's stomach, the proportion of casein must be reduced by dilution with water.

There is a wide difference, moreover, between the properties of and the results pro-

*Necessity  
for  
Modification*



## THE HOME MODIFICA-

*Properties  
of  
Casein*

duced by the casein of human milk, on the one hand, and the casein of cow's milk, on the other. The casein of mother's milk, when coagulated by the acids of the stomach forms a soft, flocculent clot, readily disintegrated, easily digested. The casein

of unmodified cow's milk, on the contrary, is digested with difficulty, and, when coagulated in the infant's stomach, forms tough, coherent curds which cause constipation and indigestion.

*Mother's  
Milk  
Alkaline*

Mother's milk when received by the infant is alkaline in reaction. Cow's milk, on the other hand, though it may be neutral in reaction or, at the best, only slightly alkaline when drawn from the udder, soon, from exposure to the air, loses its alkalinity and



## TION of COW'S MILK



shows an acid reaction.

As a result of reducing the amount of casein in cow's milk by dilution with water, the carbohydrates, originally less in amount than in mother's milk, become still further reduced and the deficiency

*Effects of  
Dilution*

must be made up by the addition of a suitable sugar.

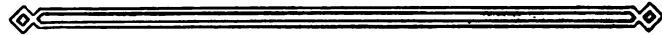
Dilution of cow's milk with water also decreases the proportion of fat, a deficiency which must be overcome by the use of top milk or cream, in amounts to be determined by the needs of individual cases.

These differences suggest the following :—

## THE HOME MODIFICA-



# TION of COW'S MILK



## RULES FOR THE MODIFICATION OF COW'S MILK

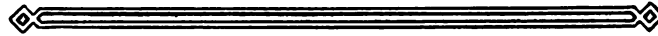
1. Reduce the proportion of casein.
2. Soften the casein in order to make it more easily digestible and to arrest its tendency to form tough and tenacious curds. *Fundamental Rules for Modification*
3. Make the milk alkaline.
4. Increase the carbohydrates, originally insufficient in amount and made still more so by the necessary dilution.
5. Adapt the quantity of fat to the individual case.

## THE HOME MODIFICA-



*“And the maize field grew and ripened,  
Till it stood in all the splendor  
Of its garments green and yellow.”*

# TION of COW'S MILK



## REDUCE THE PROPORTION OF CASEIN

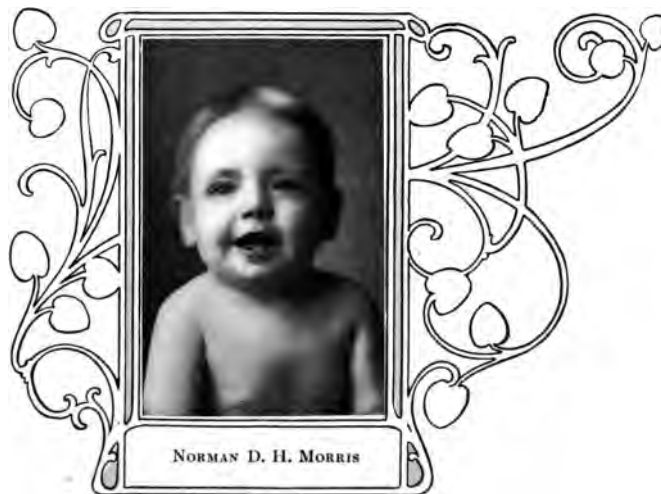


THE dilution of cow's milk with pure water is the best and most practical way to reduce the proportion of casein. Different proportions of milk and water must, however, be used, in order that, as the child grows, the proportion of nutritious elements may be increased. On account of the difference in the character of the proteids in cow's milk and the proteids of human milk, varying proportions of milk and water must be used according to the age of the child. That there may be the proper amount of proteids in the food of a child two weeks old about three parts of water to one of milk must be

*Proportion  
of  
Proteids*

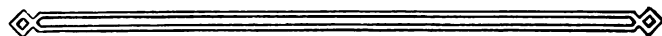
## THE HOME MODIFICA-

taken, while to have the right amount of proteids for a child six months of age, the proportions are reversed, and one part of water to three of milk is approximately the correct ratio.





# TION of COW'S MILK



## SOFTEN THE CASEIN



HAT is the best way to modify the casein that it may be more digestible, and that its tendency to form tough and tenacious curds may be arrested?

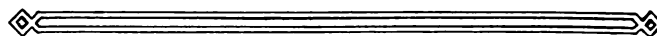
One method of modifying milk is by the addition of milk sugar. Other methods make use of starchy products, but when milk is modified with *Mellin's Food* the casein is softened and attenuated by the maltose and dextrine in the Mellin's Food.

Milk sugar is incapable of favorably affecting the digestive power of the stomach, while dextrine, present in large quantities in Mellin's Food, being itself a peptogen, facilitates the secretion of pepsin and thereby increases the digestive power.

*Attenuation  
of Casein*

*Dextrine a  
Peptogen.*

## THE HOME MODIFICA-



An attempt to soften casein by means of a starchy product will not give the desired result, because starch is insoluble and has no softening action on the casein. The result is a mechanical mixture only. Furthermore, for infants of tender age the introduction of starch into the stomach is unwise, as young infants do not have the power of digesting starch.

*Modification of Casein.* Those who have used milk sugar for the modification of milk have discovered that the quantity of milk which, when combined with water and milk sugar, can be assimilated by the infant, is so small that it gives an amount of proteids much less than is needed for the proper nourishment of the child. There is no such complaint from those who use Mellin's Food. The child that is fed on milk modified with Mellin's Food can digest with ease the necessary amount of proteids. That Mellin's Food *really* modifies milk, while

## TION of COW'S MILK

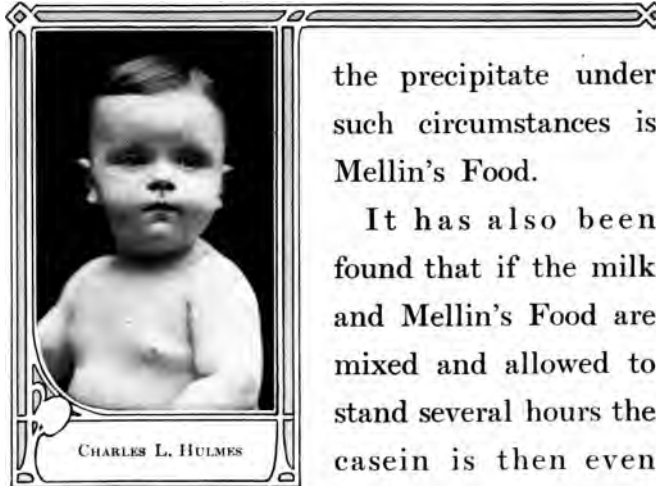
milk sugar does not, is the explanation of these two facts.

The addition of Mellin's Food softens the casein and makes it less likely to cause constipation by preventing the formation of hard cheesy masses, but the addition of milk sugar produces no such effect.

When milk becomes sour, or when it is acted upon by rennet, it coagulates and the casein separates in clots. Many other substances, if present in the milk at the time this action takes place, are in part occluded and combined with the casein. Professor Leeds gives quantitative results of the amounts of various substances thus carried down. When milk is mixed with a solution of Mellin's Food and the mixture coagulated, a portion of the Mellin's Food is occluded and the result of a quantitative test shows that about thirty per cent of the weight of

*Occlusion.*

## THE HOME MODIFICA-



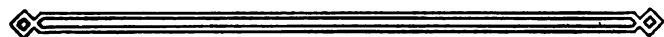
the precipitate under such circumstances is Mellin's Food.

It has also been found that if the milk and Mellin's Food are mixed and allowed to stand several hours the casein is then even more digestible, or, in

*Sufficient time for Action* other words, more casein will be digested in a given time, thus showing that the Mellin's Food *actually modifies the character* of the casein.

*Actual Modification* Repeated experiments made with Mellin's Food and milk on the one hand, and with milk sugar and milk on the other, show that casein occludes more than twice as much Mellin's Food as it does of milk sugar. The occluded Mellin's Food retains, moreover, its

## TION of COW'S MILK



characteristic solubility; when it is dissolved by the juices of the stomach it leaves the casein soft, flocculent, sponge-like; easily permeated by the digestive juices and incapable of existing as a tough, tenacious curd.

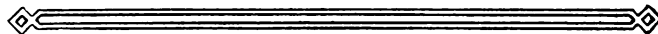


## THE HOME MODIFICA-



*"And now came the reapers, sturdy and strong,  
To gather the waving grain."*

# TION of COW'S MILK



## MAKE THE MILK ALKALINE



IN many methods of modification of cow's milk, the desired alkalinity is obtained by lime-water; in others bicarbonate of soda is used. In modification with Mellin's Food we have bicarbonate of potassium. If we inquire which alkali is the most natural one, i.e., which one is present in greatest quantity in human milk, there can be but one answer — bicarbonate of potassium.

The relative amount of potassium salts is greater in woman's milk than in cow's milk. (Leeds.)

In Harrington's analysis of the ash of human milk, the proportion of total lime salts is 30.24 per cent; of potassium salts, 43.85. The *alkali* present in greatest quantity in the *ash of human milk* is carbonate of *potassium*. Potassium salts predominate largely over the other bases in the mineral

*Natural  
Alkali*

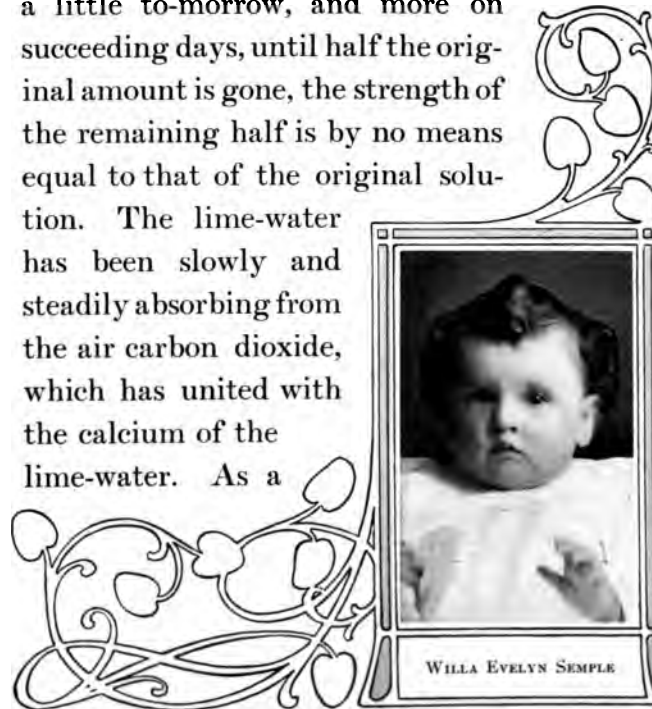
*Predominance  
of Potassium*



## THE HOME MODIFICA-

constituents or ash of the blood corpuscles and of muscular tissue; potassium phosphate is present in large proportion, while lime salts exist only in small amounts.

A solution of lime-water freshly made is of definite strength, but if used, a little to-day, a little to-morrow, and more on succeeding days, until half the original amount is gone, the strength of the remaining half is by no means equal to that of the original solution. The lime-water has been slowly and steadily absorbing from the air carbon dioxide, which has united with the calcium of the lime-water. As a



## TION of COW'S MILK

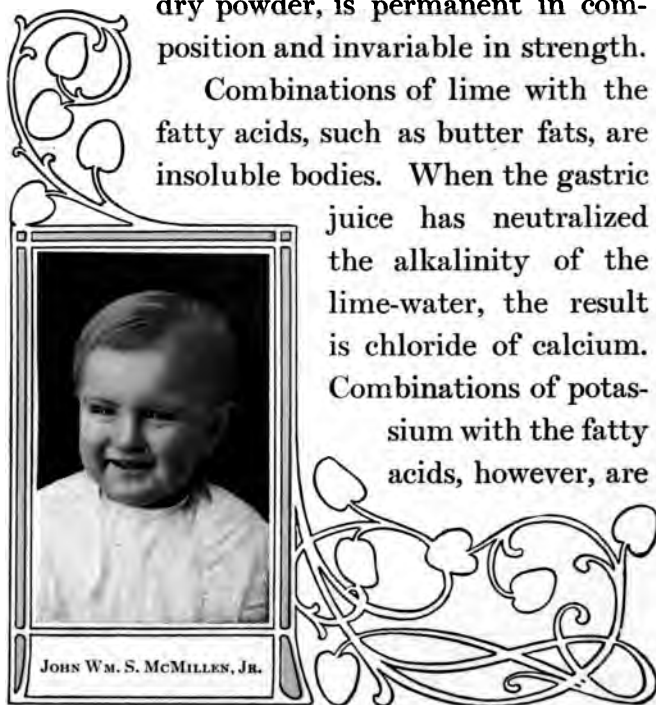
result of the union there has been formed and precipitated calcium carbonate, common chalk, a compound absolutely insoluble in water and therefore incapable of being redissolved by the solution. Bicarbonate of potassium, however, whether in solution or in the form of a

dry powder, is permanent in composition and invariable in strength.

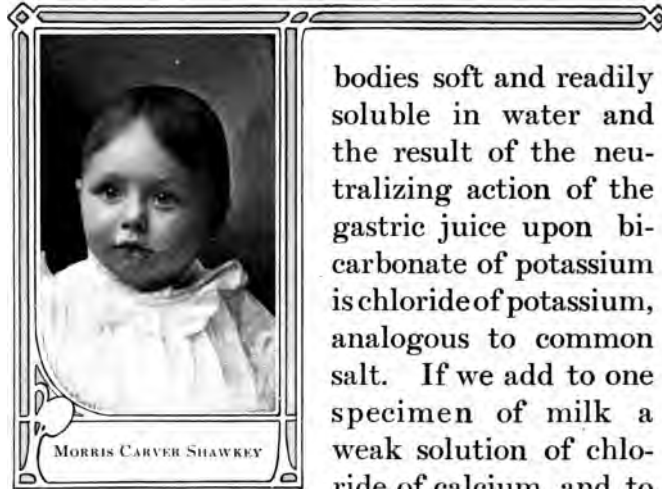
Combinations of lime with the fatty acids, such as butter fats, are insoluble bodies. When the gastric juice has neutralized the alkalinity of the lime-water, the result is chloride of calcium. Combinations of potassium with the fatty acids, however, are

*Instability of  
Lime-water*

*Lime Salts  
Insoluble*



## THE HOME MODIFICA-



bodies soft and readily soluble in water and the result of the neutralizing action of the gastric juice upon bicarbonate of potassium is chloride of potassium, analogous to common salt. If we add to one specimen of milk a weak solution of chloride of calcium, and to

*after Curds  
with Potas-  
sium*

another, one of chloride of potassium, we find, on adding a solution of rennet, that the potassium salt causes the milk to coagulate in softer and more soluble clots than are those produced by the calcium salt.

*vention of  
Constipation*

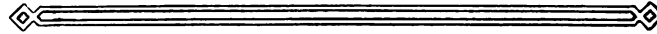
Potassium salts are less liable to cause constipation than lime salts. (Cheadle.)

Potassium salts are more effective in preventing the discharge of hard curds than lime salts. (Roberts.)

From the foregoing we summarize these facts:—

1. In the ash of human milk the alkalinity depends upon the presence of potassium salts and *not* of lime salts.

## TION of COW'S MILK



2. Potassium bicarbonate is permanent in composition, while lime-water is often of deficient alkalinity and always variable.

3. Potassium salts of the fatty acids are soft and soluble. *Lime salts are insoluble.*

4. Potassium chloride causes a slower coagulation and less tough curds than do lime salts.

*Slow  
Coagulation*

5. Potassium salts are less likely to cause constipation than are lime salts.



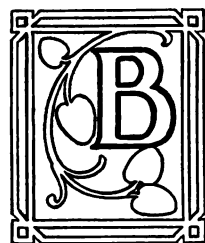
## THE HOME MODIFICA-



*“Turn, turn, O Mill! Turn round and round,  
Without a pause, without a sound.”*

# TION of COW'S MILK

## INCREASE THE CARBOHYDRATES



Y the dilution of cow's milk with water in order to lessen the proportion of casein, the small percentage of carbohydrates becomes still less. This deficiency must be made up.

In many attempts at modification of cow's milk, the deficiency of carbohydrates is overcome by the addition of milk sugar. In the modification by Mellin's Food the needed carbohydrates are supplied by the maltose and dextrine in the Mellin's Food.

The carbohydrates by their oxidation keep up the supply of heat in the system — not that this is their sole office, but it is probably their principal function.

Which of the sugars, milk sugar or maltose, is capable of supplying the greatest heat? The chemical formulas are identical.

Milk sugar . . .  $C_{12} H_{22} O_{11} + H_2 O$

Maltose . . . .  $C_{12} H_{22} O_{11} + H_2 O$

(Roscoe.)

*Deficiency  
of  
Carbohy-  
drates*

*Composition  
of  
Carbohy-  
drates*

## THE HOME MODIFICA-

### *Amount of Heat Units*

There are the same number of units of Carbon and Hydrogen in each sugar, and by oxidation they necessarily yield the same amounts of carbonic acid and water, and consequently produce the same amount of energy. There can be no difference in their action in *this* respect.

### *Milk Sugar*

Is it true that human milk contains commercial milk sugar? Is it true that when commercial milk sugar is added to an infant food the sugar is in precisely the same condition as it exists in natural milk? Do we *know* that the sugar obtained from cow's milk is physiologically identical with the sugar





## TION of COW'S MILK

existing in human milk? The caseins are different; the mineral salts are different; why then should it be taken for granted that the sugars are identical? A freshly made solution of milk sugar is different in some of its properties from a solution which has been allowed to stand for several hours. Tested by the polariscope, the rotating power of a fresh solution of milk sugar is nearly double that of the *same* solution after standing. The solubil-

*Peculiarities  
of  
Milk Sugar*

ity of different brands of commercial milk sugar varies. Pavy has shown that milk sugar obtained by treating the milk with rennet gives different reactions from those which



## THE HOME MODIFICA-

occur in milk sugar obtained by the use of acetic acid. Commercial milk sugar is a chemical product; it is a waste product obtained from the whey which comes from cheese factories. The whey when sour is neutralized with lime or magnesia and hence lactates of these bases are often found in the ash of the milk sugar.

*Bacteria in  
Milk Sugar*

Professor Leeds states that in all his examinations of milk sugar obtained from drug stores, an abundant crop of bacteria developed when samples were submitted to the ordinary gelatin-peptone culture.

Dr. E. F. Brush says :—

*Milk Sugar  
Eliminated*

“Sugar of milk in *human* milk is all assimilated, while the milk sugar of commerce, when added to baby’s food, is eliminated both by the kidneys and bowels. This I have demonstrated by numerous experiments.”

Maltose is assimilated without further change in the intestinal tract.

## TION of COW'S MILK

Maltose does not readily undergo acetous fermentation.

(Fothergill.)

It (maltose) will *not* give rise to acidity and dyspepsia.

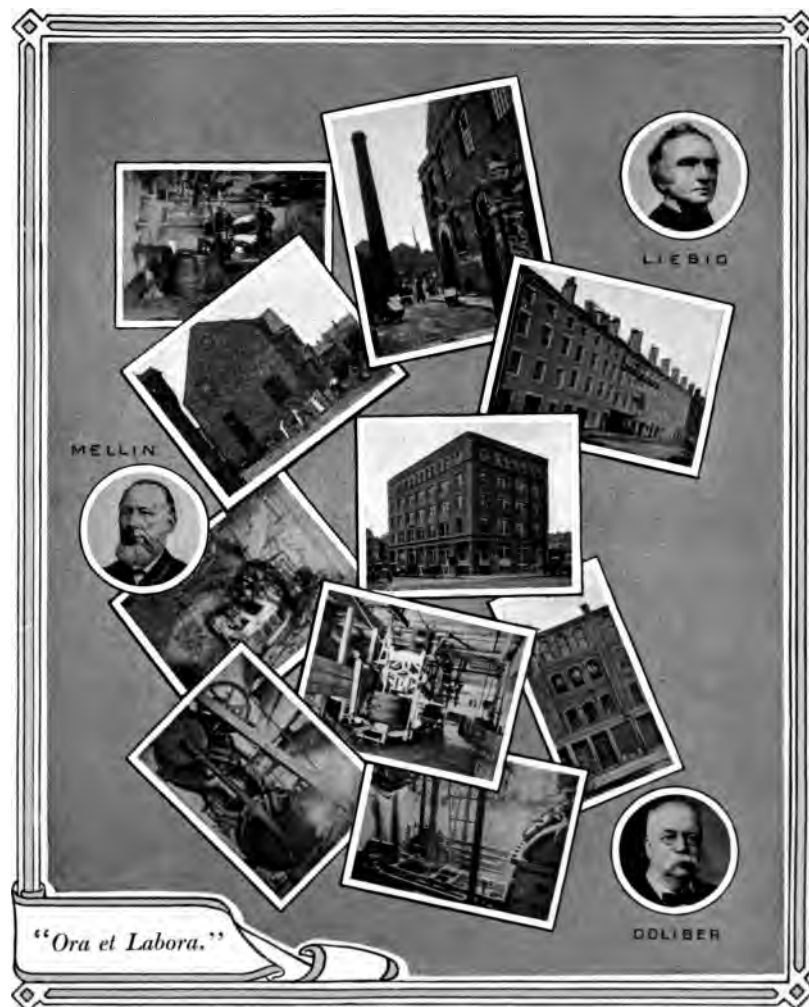
(Dr. Mitchell Bruce.)

There is, therefore, not the slightest reason for thinking that milk sugar, for any reason, either theoretical or practical, is as desirable as maltose as a means of increasing the carbohydrates in milk.

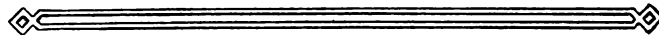
*Maltose*  
*Preferable*



# THE HOME MODIFICA-



# TION of COW'S MILK



## ADAPT THE AMOUNT OF FAT



**W**HILE, on the one hand, the cow's milk must be so modified that the casein shall be reduced, the relative proportions of casein and albumen adjusted, the casein rendered soluble and digestible, the milk made alkaline and the deficiency of the carbohydrates overcome, the adaptation of the amount of fat, on the other hand, gives opportunity for greater consideration and can be determined only by the requirements, conditions and idiosyncrasies of the individual. When milk is modified by Mellin's Food all the fat must needs be supplied by the milk, since the Mellin's Food itself contains only an inconsiderable amount of fat derived from the grains used in its manufacture.

An additional amount of fat, if required, may be obtained by the use of top milk or cream.

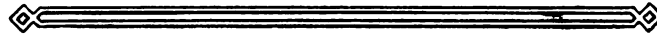
*Fat to suit  
Conditions*

## THE HOME MODIFICA-



*"He has carried every point who has mingled the useful with the agreeable."*

# TION of COW'S MILK



## THE ANTISCORBUTIC ELEMENT



It is not sufficient that an infant's food should in its chemical composition be like mother's milk. Another requisite is quite as essential.

To insure healthy nutrition an infant food must contain the *antiscorbutic element*, and this antiscorbutic element can be found in fresh food only. The persistent deprivation of fresh food is the most frequent direct cause of infantile scurvy. Children fed on fresh milk—either cow's milk or breast milk—never have scurvy, unless in the case of artificially-fed infants the quantity of fresh milk is too small, or in the case of those fed at the breast, the mother is scorbutic.

"In no instance," writes Dr. W. B. Cheadle, "have I seen the disease arise in an infant at the breast, or when fed on an ample supply of good cow's milk. Experience shows that by desiccation milk loses some antiscorbutic

*Fresh Food  
prevents  
Scurvy*



## THE HOME MODIFICA-



ALEXANDER W. BRINDLE

property, and it would seem that its power of making red blood—its hæmic virtue—is in some degree impaired. Children brought up on dried foods alone, without any addition whatever, are apt to become pallid, deficient in robust vitality, and

even rachitic. *A fresh animal element must be added.*” It must be remembered that it is milk that is fresh and *raw* that contains the antiscorbutic element. Sterilized milk is not raw milk and is therefore not an antiscorbutic diet. The long process of heating to which it is necessarily subjected destroys the antiscorbutic element present in fresh milk, and renders it far less nutritious. Prof. Leeds very tersely expresses the situation when he states that *the deaths due to malnutrition from feeding sterilized milk have exceeded a*

## TION of COW'S MILK

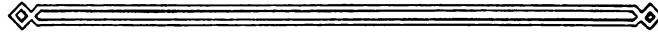
*hundred-fold those caused by disease germs in fresh milk.*

Dr. Cheadle's experience with sterilized milk is stated by him as follows :—"Although sterilized milk answers admirably for a time, children kept on it throughout eventually lose firmness of flesh and vigor, and do not thrive into robustness. I am convinced that the process [of sterilization] impairs the value of the nitrogenous element in some degree."

There has not been discovered any tangible cause of scurvy. As far as we know, it is not caused by the *presence* of anything deleterious in the food, but rather by the *lack* of something—a lack of freshness, a lack of something which is in fresh milk but which is not in stale milk or in *cooked* milk. Fresh, raw, cow's milk contains the antiscorbutic element. It is, therefore, evident that a diet of Mellin's Food and milk and water is an antiscorbutic diet.

*Mellin's Food  
and  
Fresh Milk  
an  
Antiscorbutic  
Diet*

# THE HOME MODIFICA-



## WHAT MELLIN'S FOOD ITSELF IS

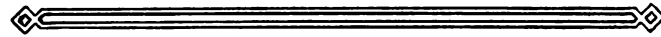
Mellin's Food is a means to aid the physician in modifying fresh cow's milk.

Mellin's Food is a dry, soluble extract made from barley-malt and wheat.

Mellin's Food consists of maltose, dextrine, proteids and salts and is *entirely free* from starch and cane sugar.

Mellin's Food is the only true Liebig's Food.

## TION of COW'S MILK

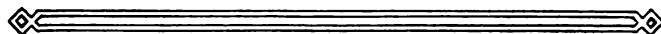


Mellin's Food is not affected by either time or climate.

What Mellin's Food was, when first made, it is today.



# THE HOME MODIFICA-



## FORMULAS AND ANALYSES



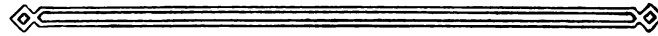
AS an illustration of the wide range possible in the modification of cow's milk with Mellin's Food, we give a series of formulas which have been arranged with due regard to

*Soluble  
Proteids of  
Mellin's Food*

the limitations of the home. If the percentage of proteids in these seems greater than the proportion of proteids known to exist in cow's milk, when diluted with the given amount of water, it must be remembered that the proteids come not only from the casein of the cow's milk but also from the *soluble and digestible* albumen of the Mellin's Food.

Realizing that it is not the child's age alone which determines the needed amounts of proteids, carbohydrates, salts or fat, but that other factors—strength, weight, vigor, etc.—exert their influences, we must not regard these formulas as cast-iron rules to be

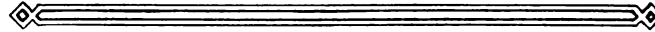
## TION of COW'S MILK



followed in modifying milk for children of different ages, but we must look upon them as guides in selecting the proper proportions. To the practitioner they will suggest other formulas, and will show that, when necessary, any desired proportion of constituents may be obtained by varying the proportions of the Mellin's Food, milk, cream and water.

*Any  
Proportion  
Obtainable*

# THE HOME MODIFICA-



*For Infants about Two Weeks Old.*

Mellin's Food,	}	Gives this Composition	Fat . . . . .	1.01
4 teaspoonfuls;			Proteids . . . . .	1.12
Milk,			Carbohydrates (no starch)	2.01
4 $\frac{1}{4}$ fluid ounces;			Salts . . . . .	.23
Water,			Water . . . . .	95.63
11 $\frac{3}{4}$ fluid ounces.				100.00

*For Infants about One Month Old.*

Mellin's Food,	}	Gives this Composition	Fat . . . . .	1.18
5 teaspoonfuls			Proteids . . . . .	1.32
(level);			Carbohydrates (no starch)	2.42
Milk,			Salts . . . . .	.28
5 fluid ounces;			Water . . . . .	94.80
Water,				100.00
11 fluid ounces.				

*For Infants about Six Weeks Old.*

Mellin's Food,	}	Gives this Composition	Fat . . . . .	1.41
5 teaspoonfuls			Proteids . . . . .	1.56
(level);			Carbohydrates (no starch)	2.69
Milk,			Salts . . . . .	.32
6 fluid ounces;			Water . . . . .	94.02
Water,				100.00
10 fluid ounces.				

# TION of COW'S MILK

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*For Infants about Two Months Old.*

Mellin's Food, 6 teaspoonfuls (level);	} Gives this Composition	Fat . . . . .	1.53
Milk, 6½ fluid ounces;		Proteids . . . . .	1.69
Water, 9½ fluid ounces.		Carbohydrates (no starch)	3.03
		Salts . . . . .	.35
		Water . . . . .	93.40
			100.00

*For Infants about Three Months Old.*

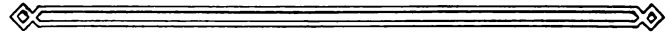
Mellin's Food, 1 tablespoonful (heaping);	} Gives this Composition	Fat . . . . .	1.86
Milk, 8 fluid ounces;		Proteids . . . . .	2.08
Water, 8 fluid ounces.		Carbohydrates (no starch)	3.82
		Salts . . . . .	.44
		Water . . . . .	91.80
			100.00

*For Infants about Three Months Old. (Rich milk.)*

Mellin's Food, 1 tablespoonful (heaping);	} Gives this Composition	Fat . . . . .	2.13
Rich Milk, 8 fluid ounces;		Proteids . . . . .	1.99
Water, 8 fluid ounces.		Carbohydrates (no starch)	4.19
		Salts . . . . .	.51
		Water . . . . .	91.18
			100.00



# THE HOME MODIFICA-



## *For Infants about Four Months Old.*

Mellin's Food, 10 teaspoonfuls (level); Milk, 9½ fluid ounces; Water, 6½ fluid ounces.	} Gives this Composition	Fat . . . . .	2.19
		Proteids . . . . .	2.47
		Carbohydrates (no starch)	4.60
		Salts . . . . .	.52
		Water . . . . .	90.22
			<hr/> 100.00

## *For Infants about Five Months Old.*

Mellin's Food, 13 teaspoonfuls (level); Milk, 10½ fluid ounces; Water, 5½ fluid ounces.	} Gives this Composition	Fat . . . . .	2.40
		Proteids . . . . .	2.75
		Carbohydrates (no starch)	5.42
		Salts . . . . .	.59
		Water . . . . .	88.84
			<hr/> 100.00

## *For Infants about Six Months Old.*

Mellin's Food, 2 tablespoonfuls (heaping); Milk, 12 fluid ounces; Water, 4 fluid ounces.	} Gives this Composition	Fat . . . . .	2.72
		Proteids . . . . .	3.14
		Carbohydrates (no starch)	6.35
		Salts . . . . .	.68
		Water . . . . .	87.11
			<hr/> 100.00

# TION of COW'S MILK

*For Infants about Six Months Old. (Rich milk.)*

Mellin's Food, 2 tablespoonfuls (heaping); Rich Milk, 12 fluid ounces; Water, 4 fluid ounces.	Gives this Composition	Fat . . . . .	3.10
		Proteids . . . . .	3.00
		Carbohydrates (no starch)	6.90
		Salts . . . . .	.79
		Water . . . . .	86.21
			<hr/> 100.00

*For Infants about Six Months Old. (Top milk.)*

Mellin's Food, 2 tablespoonfuls (heaping); Top Milk, (upper half of milk after standing 4 hours) 12 fluid ounces; Water, 4 fluid ounces.	Gives this Composition	Fat . . . . .	4.04
		Proteids . . . . .	3.04
		Carbohydrates (no starch)	6.73
		Salts . . . . .	.77
		Water . . . . .	85.42
			<hr/> 100.00

*Low Proteids.*

Mellin's Food, 2 tablespoonfuls (heaping); Milk, 4 fluid ounces; Cream, 1½ tablespoonfuls; Water, 12 fluid ounces.	Gives this Composition	Fat . . . . .	2.50
		Proteids . . . . .	1.45
		Carbohydrates (no starch)	4.18
		Salts . . . . .	.37
		Water . . . . .	91.50
			100.00

# THE HOME MODIFICA-

## *Low Proteids and Low Carbohydrates.*

Mellin's Food, 11 teaspoonfuls (level); Top Milk, (upper half of milk after standing 4 hours) 6 fluid ounces; Water, 10 fluid ounces.	Gives this Composition	Fat . . . . .	2.25
		Proteids . . . . .	1.58
		Carbohydrates (no starch)	4.07
		Salts . . . . .	.42
		Water . . . . .	91.68
			<hr/> 100.00

## *High Fat and Low Proteids.*

Mellin's Food, 3 tablespoonfuls (heaping); Milk, 4 fluid ounces; Cream, 2 tablespoonfuls; Water, 12 fluid ounces.	Gives this Composition	Fat . . . . .	3.00
		Proteids . . . . .	1.65
		Carbohydrates (no starch)	5.54
		Salts . . . . .	.45
		Water . . . . .	89.36
			<hr/> 100.00



